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REVIEW ARTICLE

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Intersphincteric resection for very low rectal cancer: A review of the updated literature

Kazuo Shirouzu[1] | Naotaka Murakami[1] | Yoshito Akagi[2]

[1]Department of Gastrointestinal Surgery, Japan Community Health care Organization, Kurume General Hospital, Kurume, Japan

[2]Department of Surgery, Kurume University Faculty of Medicine, Kurume, Japan

Correspondence
Kazuo Shirouzu, Department of Gastrointestinal Surgery, Japan Community Health care Organization, Kurume General Hospital, Kurume, Fukuoka, Japan.
Email: nagomiflute@yahoo.co.jp

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Abstract

Intersphincteric resection (ISR) has rapidly increased worldwide including laparoscopic surgery. However, there are some concerns for the definition of ISR, surgical technique, oncological outcome, anal function, and quality of life (QoL). The aim of the present study is to evaluate those issues. A review of this surgical technique was carried out by searching English language literature of the PubMed online database and appropriate articles were identified. With regard to open-ISR, the morbidity rate ranged from 7.5% to 38.3%, with lower mortality rates. Local recurrence rates varied widely from 0% to 22.7%, with a mean follow-up duration of 40–94 months. Disease-free and overall 5-year survival rates were 68–86% and 76–97%, respectively. Those outcomes were equivalent to laparoscopic-ISR. Surgical and oncological outcomes of ISR were generally acceptable. However, accurate evaluation of anal function and QoL was difficult because of a lack of standard assessment of various patient-related factors. The surgical and oncological outcomes after ISR seem to be acceptable. The ISR technique seems to be valid as an alternative to abdominoperineal resection in selected patients with a very low rectal cancer. However, both necessity for ISR and expectations of QoL impairment as a result of functional disorder should be fully discussed with patients before surgery.

KEYWORDS
functional outcome, intersphincteric resection, local recurrence, oncological outcome, rectal cancer, survival

1 | INTRODUCTION

Surgical treatment for very low rectal cancer is very difficult because of the higher rate of local recurrence (LR) and lower rate of survival. Abdominoperineal resection (APR) reported by Miles has been used for a long time as a standard surgical procedure for lower rectal cancer.[1] However, APR characterized by a permanent colostomy has not been easily accepted by patients. In 1972, low anterior resection followed by hand-sewn coloanal anastomosis (CAA) introduced by Parks became widely adopted around the world as an excellent procedure for lower rectal cancer to preserve the anus.[2] However, anal preservation may have a higher risk of LR than non-preservation. In the latter half of the 1900s, total mesorectal excision (TME),[3] preoperative chemoradiotherapy (CRT), and optimal circumferential resection margin (CRM) suggested both good control of LR and survival benefit.[4,5] Also, CRT influenced down-staging of the tumor, and allowed sphincter-saving operation for some patients who may have required APR.[6] In addition to those aspects, shorter distal resection margin proposed

by clinicopathological studies has encouraged surgeons to preserve the anus.[7–13] In 1994, Schiessel *et al.* introduced intersphincteric resection (ISR) followed by hand-sewn CAA as an anal preservation procedure for very low rectal cancer closer to the anus.[14] ISR is the ultimate anal preservation surgery by both abdominal and anal approaches which consists of TME and excision of the internal anal sphincter. The surgical technique changed the concept of anal preservation and, since 2000, has rapidly expanded not only in Europe, but also in Japan and other Asian countries.[15–53] Also, laparoscopic-ISR has come to be aggressively carried out.[38–42] Many researchers have reported the surgical, oncological, and functional outcomes. However, some studies including conventional Parks' CAA, or low anterior resection with stapled anastomosis have caused misunderstanding of ISR. Moreover, quality of life (QoL) impairment caused by fecal incontinence remains unclear.[20,46,48,54–56] The present review investigates and discusses the surgical, oncological and functional outcomes, as well as QoL, of ISR.

2 | METHODS

A literature search of PubMed online database in the English language was carried out and appropriate articles associated with ISR were identified including laparoscopic surgery. Some studies specializing in conventional Parks' CAA and in stapler CAA (ultralow anterior resection with stapled anastomosis) were excluded. Multiple publications involving the same series of patients (or duplicate patient populations) were identified and grouped together with only the most recent or primary study to avoid double-counting of patients.

3 | RESULTS

3.1 | Indication

Available data were extracted from 22 articles[21–42] and are summarized in Table 1. The most common indication for ISR is a tumor with T1–3 categories and a tumor located at 10–50 mm from the anal verge. Contraindication is the presence of untreatable distant metastasis, poorly differentiated carcinoma, poor anal function, psychiatric disease, and a fixed tumor (T4 lesion) which invades the puborectal muscles and/or external anal sphincter.

3.2 | Neoadjuvant chemoradiotherapy and surgical outcomes

Neoadjuvant chemoradiotherapy was commonly given, but its use varied widely, ranging from 0 to 100%,[21–42] as shown in Table 2.

TABLE 1 Characteristics of patients and tumors

Author[a]	Year	No. patients	Age (years)	Sex (M(%)/F)	Distance from AV (DL) (mm)	T category
Köhler *et al.*[21]	2000	31	60	17(55)/14	13 ± 9 (DL)	T1–T3
Vorobiev *et al.*[22]	2004	27	55 (26–75)	16(59)/11	10 (5–15) (DL)	T2–T3
Schiessel *et al.*[23]	2005	121	65/62 (M/F)	83(69)/38	30 (10–50)	T1–T3
Rullier *et al.*[24]	2005	92	65 (25–86)	57(62)/35	30 (15–45)	T1–T3
Hohenberger *et al.*[25]	2006	65	NR	NR	<20 (DL)	T1–T2
Chin *et al.*[26]	2006	18	61 (42–79)	7(39)/11	10–30 (DL)	T2–T3 (T4)
Saito *et al.*[27 b]	2006	228	58 (27–77)	168(74)/60	34 (20–50)	T1–T3 (T4)
Chamlou *et al.*[28]	2007	90	59 (27–82)	59(66)/31	35 (22–52)	T1–T3 (T4)
Portier *et al.*[29]	2007	173	64	57(33)/116	41 ± 1.4	T1–T3 (T4)
Krand *et al.*[30]	2009	47	57 (27–72)	31(66)/16	33 (15–50)	T2–T3
Han *et al.*[31]	2009	40	62 (34–73)	24(60)/16	20–50 (DL)	T1–T2
Weiser *et al.*[32]	2009	44	54 (28–78)	25(57)/19	50 (30–60)	T3–T4
Kuo *et al.*[33]	2011	26	51 (26–71)	16(62)/10	35 (25–50)	T3–T4
Gong *et al.*[34]	2012	43	53	27(63)/16	<50	T1–T2
Akagi *et al.*[35]	2013	124	65 (32–81)	77(62)/47	30 (10–40)	T1–T3 (T4)
Tokoro *et al.*[36]	2013	30	59 (31–75)	16(53)/14	8.9 (–3–25) (DL)	Tis–T3
Saito *et al.*[37]	2014	199	59 (27–80)	144(72)/55	35 (10–55)	T1–T4
Rullier *et al.*[38]	2003	32	64 (37–75)	21(66)/11	<50	T1–T4
Park *et al.*[39]	2011	210	61	141(67)/69	36–47	T1–T4
Laurent *et al.*[40]	2011	175	64	117(67)/58	35–40	T1–T4
Kuo *et al.*[41]	2013	58	53	36(62)/22	36	T1–T4
Kanso *et al.*[42]	2015	85	59 (32–82)	62(73)/23	17 (0–35) (DL)	T0–T4

[a]Available data were summarized.
[b]Japanese experience, including our data.
AV, anal verge; DL, dentate line; F, female; M, male; NR, not reported.

TABLE 2 Surgical procedures

Author	No. patients	Pre-op CRT (%)	Method of ISR P-ST/T/ESR	J-Pouch anastomosis (%)	Diverting stoma (%)
Köhler *et al.*[21]	31	0	31/0/0	0	100
Vorobiev *et al.*[22]	27	7	0/27(100%)/0	100 (C-pouch)	100
Schiessel *et al.*[23]	121	0	P-ST, T	0	100
Rullier *et al.*[24]	92	88	P-ST, T	57	100
Hohenberger *et al.*[25]	65	65	P-ST	Sometimes	100
Chin *et al.*[26]	18	33	NR	100	100
Saito *et al.*[27a]	228	25	159/69 (T/ESR)	22	NR
Chamlou *et al.*[28]	90	41	P-ST	100	100
Portier *et al.*[29]	173	53	P	NR	100
Krand *et al.*[30]	47	100	47/0/0	40 (coloplasty)	100
Han *et al.*[31]	40	2.5	35/5(13%)/0	18	28
Weiser *et al.*[32]	44	100	44/0/0	48	NR
Kuo *et al.*[33]	26	88	26/0/0	0	100
Gong *et al.*[34]	43	0	43/0/0	NR	0
Akagi *et al.*[35]	124	0	T, ST	NR	100
Tokoro *et al.*[36]	30	0	14/12(40%)/4	87	100
Saito *et al.*[37]	199	25	144/55 (/41)	NR	100
Rullier *et al.*[38]	32	91	32/0/0	100 (coloplasty)	100
Park *et al.*[39]	210	5.2	NR	0	9.5
Laurent *et al.*[40]	175	90	119/56(32%)/0	NR	100
Kuo *et al.*[41]	58	95	NR	0	NR
Kanso *et al.*[42]	85	84	64/21/0	0	100

[a]Japanese experience including our data.
ESR, external anal sphincter resection (ISR with combined resection of partial or extended external sphincter); ISR, intersphincteric resection; NR, not reported; P, partial; Pre-op CRT, preoperative chemoradiotherapy; ST, subtotal; T, total.

3.3 | Surgical technique

Based on the concept of TME,[3] the rectum is mobilized down to the upper level of the levator ani muscle. Dissection of the intersphincteric space (ISS) between the internal anal sphincter (IAS) and external anal sphincter (EAS) is begun from the posterior side of the rectum by transecting the hiatal (anococcygeal) ligament. Then, circumferential dissection of the intersphincteric space in the anal canal is carried out from the bilateral lateral side to the anterior part. The dissection is advanced to a level lower than the dentate line (DL) in order to facilitate the transanal approach. Circular incision of the anal canal is started at the DL in partial-ISR, between the dentate line and intersphincteric groove in subtotal-ISR, and at the intersphincteric groove in total-ISR.[35] The IAS is dissected from the EAS, prostate, vagina, and puborectal muscle, and then the dissection is connected to the transabdominal dissection. After the rectum is completely separated from the anal canal structures, the specimen is taken out of the anus. Thereafter, hand-sewn CAA is done using straight colon,[21,23,33] J-pouch,[26,28] coloplasty[30] or C-pouch.[22] Smooth muscle plasty was devised as a neo-sphincter to improve anal function.[22,30] Combined EAS resection (ESR) is sometimes carried out for tumors with suspected invasion into the intersphincteric space and/or EAS.[17,44,53] Finally, protective diverting ileostomy or colostomy is commonly created. An example of open-ISR technique is shown on the supplementary video (Video 1).[17,35,49]

3.4 | Morbidity and mortality

Regarding open surgery, the rate of overall morbidity varied widely from 7.5% to 38.3% (Table 3).[21–42] Operative mortality was rare (0–1.7%). Morbidities included anastomotic leakage, pelvic abscess, colonic ischemia (or necrosis), ileus, ano-vaginal fistula and others. Anastomotic leakage occurred in 4.3–48% of cases, and subsequent stenosis was observed in 8.4–23.3% of cases. These outcomes were almost equivalent to laparoscopic-ISR.

3.5 | Oncological outcomes

Oncological outcomes are summarized in Table 4. As to open-ISR, the rate of radical surgery (R0 resection) was over 90%. The distal resection margin (DRM) was maintained from 5 to 25 mm. Frequency of a radial (circumferential) resection margin (CRM) ≤1 mm ranged from 4 to 19.6%. Rates of overall recurrence, distant metastasis, and local recurrence showed ranges of 13.3–20.0%, 0–19.0%, and 0–22.7%,

TABLE 3 Patient characteristics, surgical outcomes and postoperative complications[a]

Item	Open-ISR	Laparoscopic-ISR
Age (years)	51–65	55–64
Gender: Male/Female (%)	33–74/26–67	61–76/24–39
Body mass index (kg/m^2)	25	21.4–24.3
Distance from AV [DL] (mm)	30–50 [10–50]	33–55 [17]
T factor (T1/T2/T3/T4) (%)	3/13/83/0	0–12/11–33/43–86/0–4
Pre-op CRT (%)	0–100	26.9–100
Type of ISR: P-ST/T/ESR (%)	Almost 100/13–100/Few	73–75/25–27/0
J-Pouch anastomosis (%)	Almost <50	Almost <50
Diverting stoma (%)	Almost 100	14–100
Operating time (min)	416	185–420
Blood loss (mL)	155–265	59–303
Intraoperative transfusion (%)	10	0–1.5
Postoperative stay (days)	16–18	9–15
Operative mortality (%)	0–1.7	0–1.1
Leakage (%)	4.3–48	3.8–24
Vaginal fistula (%)	0–19.4	1.5–2.8
Vesical fistula (%)	0–0.8	0
Colonic ischemia (necrosis) (%)	0–2.0	2.5–14.3
Sepsis (%)	0–8.7	0
Pelvic abscess (%)	0–5.6	0.8–8.1
Pelvic hematoma (%)	0–6.5	0
Ileus (bowel obstruction) (%)	0–8.5	1.5–15.4
Stenosis (%)	8.4–23.3	2.4–13
Not closed (diverting stoma) (%)	0–12.5	NR
Additional surgery[b] (%)	0–12.9	NR
Grade of morbidity (%)		
Dindo I–II	96	63-95
Dindo III–V	3.8–27.7	5.4–37
Overall morbidity (%)	7.5–38.3	12.5–32.1

[a]Available data from 22 articles were summarized.[21–42]
[b]Abdominoperineal resection, Hartmann's procedure, and/or re-creation of stoma were required because of postoperative surgical and/or functional complications.
AV, anal verge; CRT, chemoradiotherapy; DL, dentate line; ESR, external anal sphincter resection (ISR with combined resection of partial or extended external sphincter); ISR, intersphincteric resection; P-ST, partial-subtotal ISR; T, total ISR.

respectively, within a mean follow-up duration from 12 to 94 months. These outcomes were almost equivalent to laparoscopic-ISR.

Disease-free and overall 5-year survival rates were excellent, with ranges of 68–86% and 76–97%, respectively. Oncological outcomes after ISR were not markedly different from those after conventional Parks' CAA or APR.[29,35] Only one study reported a significant difference in the overall and disease-free survival rates between ISR and APR.[33] Saito *et al*. reported a significant difference in overall survival rate between ISR and APR.[52] Akagi *et al*. reported no significant difference in LR and recurrence-free survival rates between ISR and APR which were carried out during the same time period.[35] These outcomes were almost equivalent to laparoscopic-ISR, but were not sufficiently evaluated because of the small number of patients and short-term follow up.

3.6 | Functional outcomes

Regarding open-ISR, anal function was assessed at 1 year after stoma closure, and the available data were summarized from 14 articles,[16,18,21–26,30,31,33,45–47] as shown in Table 5. Stool frequency/24 h varied widely from 1.8 to 5.1. Rates of stool fragmentation, urgency, nocturnal soiling, daytime soiling, and pad wearing were as follows: 15–79%, 2–52%, 24–53%, 26–35%, and 19–57%, respectively. Wexner score and Kirwan grade showed a relatively good assessment with scores <12 and lower rates of grades IV (0–27%) and V (0–5.9%). Unexpectedly, anti-diarrhea medication was not particularly necessary (0–33%). Patient satisfaction was approximately 70%. Functional outcomes of laparoscopic-ISR were not sufficiently evaluated because of lack of data.

TABLE 4 Oncological outcomes[a]

Item	Open-ISR	Laparoscopic-ISR
TNM stage: I/II/III/IV (%)	0–58/4–63/16–78/0–7	0–48/11–24/22–86/3–8
R0 resection (%)	90–100	95–96.4
Distal resection margin (mm)	5–25	12–30
Radial resection margin ≤1 mm (%)	4.0–19.6	5.0–15.5
Retrieved lymph node (*n*)	14.7	13.3–15.2
Median follow up (months)	12–94	31.5–53
Overall recurrence (%)	13.3–20.0	17.9–28.2
Distant metastasis (%)	0–19.0	8.5–24
Local recurrence (%)	0–22.7	2.6–8.2
Disease-free 3-year survival (%)	77.0	75.0–90.5
Overall 3-year survival (%)	81.6	86.6–94.8
Disease-free 5-year survival (%)	68.4–86	70–82.8
Overall 5-year survival (%)	76.5–97	85–88.4

[a]Available data from 22 articles were summarized.[21–42]
ISR, intersphincteric resection.

TABLE 5 Functional outcomes[a]

Assessment at ≥1 year after stoma closure	Open-ISR	Laparoscopic-ISR
Mean maximum resting pressure (cmH_2O)	42–75	NR
Mean maximum squeeze pressure (cmH_2O)	186–259	NR
Median stool frequency/24 h	1.8–5.1	2–6
1–3 (%)	50–85	NR
4–5 (%)	12–57.1	NR
>5 (%)	0–36	NR
Stool fragmentation (%)	15–78.9	81 (NS)
Urgency (<15 min) (%)	2–51.7	58-83
Incontinence for flatus (%)	7.7–68.2	72.8 (NS)
Nocturnal soiling (%)	23.8–52.9	92 (NS)
Daytime soiling (%)	26–35	92 (NS)
Pad wearing (%)	19–57	NR
Feces and flatus discrimination (%)	4–86	NR
Anti-diarrhea medication (%)	0–33.3	NR
Mean Wexner score (range)	2.8–12	11–14
Kirwan grade (%)		
Grade I (perfect)	13.9–84.6	NR
Grade II (incontinence of flatus)	7.7–36.6	NR
Grade III (occasional minor soiling)	3.8–38.6	NR
Grade IV (frequent major soiling)	0–27	NR
Grade V (required colostomy)	0–5.9	4.9 (NS)
Patient satisfaction (%)		
Very low	14–18	
Medium	11	NR
Perfect (almost)	71	

[a]Available data were summarized from 14 articles.[16,18,21–26,30,31,33,45–47]
NR, not reported; NS, not sufficient data.

4 | DISCUSSION

4.1 | Definition of intersphincteric resection

Schiessel *et al.* clearly defined the ISR technique, and classified the procedure into two types: subtotal ISR and total ISR.[14] According to the clinical definition by a Japanese study group that included our institute, total-ISR is defined as complete IAS removal at the intersphincteric groove (ISG); subtotal-ISR is IAS removal between the DL and ISG, and partial-ISR is defined as IAS removal at the DL (Fig. 1).[57] ISR is a surgical procedure specializing in IAS removal followed by hand-sewn CAA without mucosectomy. Partial-ISR is defined as one-third removal of the upper part of the IAS, subtotal-ISR as two-thirds removal of the IAS, and total-ISR as complete removal of the IAS. ISR must be discriminated from conventional Parks' CAA and stapler CAA.

4.2 | Indication and preoperative evaluation

When planning treatment by ISR, careful patient selection is important. Indications for laparoscopic ISR do not differ from those for open surgery. Preoperative careful evaluation of patient and tumor should be carried out. Patients with severe preoperative complications including cardiac failure, liver cirrhosis, anal dysfunction, renal dysfunction, respiratory dysfunction, and psychiatric disease appear to not be suitable for ISR.

Many authors have reported that the oncological inclusion criteria are T1–T3 tumor showing well- to moderately differentiated adenocarcinoma. Oncological exclusion criteria include T4 tumor, fixed tumor, untreatable distant metastasis, and poorly differentiated adenocarcinoma. Digital examination is important for evaluating tumor mobility and for making a final surgical decision.[24,29,31] Barium enema is shown in Figure 2. Anus preservation can be done by ISR or ESR technique for these rectal cancers.[57] Also, estimating anal

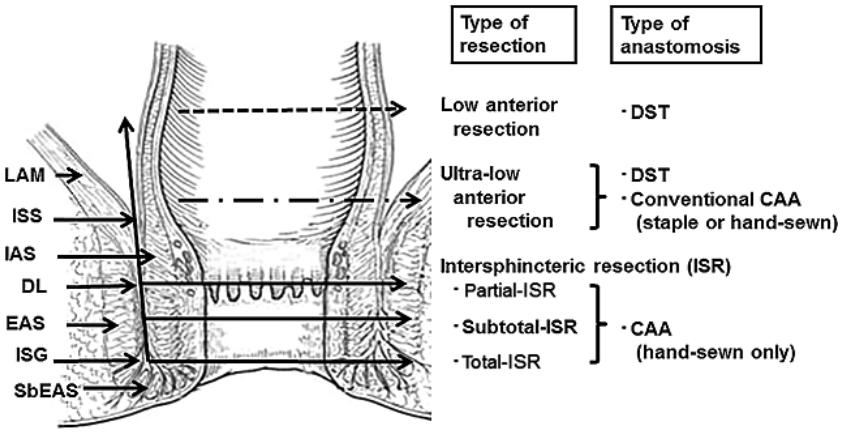

FIGURE 1 Definition of intersphincteric resection. The resection line of the rectum or anal canal varies depending on the location of the tumor from the anal verge. Total intersphincteric resection (total-ISR) is defined as an internal sphincter resection at the intersphincteric groove (ISG), subtotal-ISR is between the dentate line (DL) and ISG, and partial-ISR is at the DL. CAA, coloanal anastomosis; DST, double stapling technique; EAS, external anal sphincter; IAS, internal anal sphincter; ISS, intersphincteric space; LAM, levator ani muscle; SbEAS, subcutaneous part of external anal sphincter.

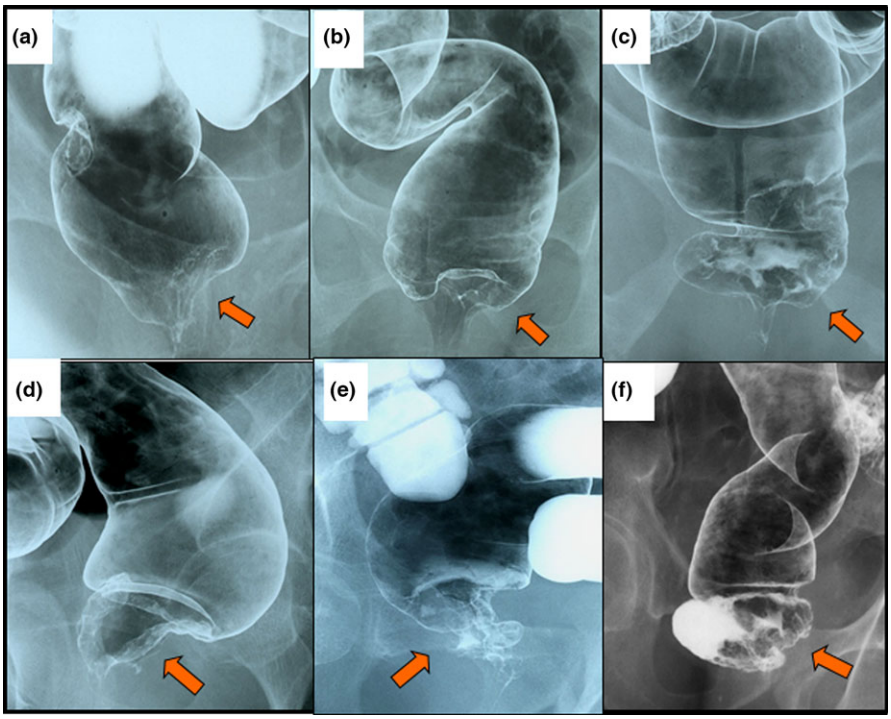

FIGURE 2 Barium enema of very low rectal cancers. Anus preservation can be carried out in patients with a very low rectal cancer by (a–c) intersphincteric resection or (d–f) external sphincter resection techniques. Arrow, location of rectal cancer.

function by digital examination is useful,[58] and comparable to manometry.[59]

4.3 | Surgical margin

Correct evaluation of tumor invasion to the anal canal complex is essential to achieve both negative distal resection margin (DRM) and circumferential (radial) resection margin (CRM). In the 21st century, better understanding of the distal spread based on the pathological studies justified reduction of the DRM from 20 mm to 10 mm.[7,8] Neoadjuvant CRT enabled the DRM to be decreased to 5–10 mm.[9–11] A DRM of 10 mm is thought to be safe and reasonable for anal preservation when ISR is applied for a very low rectal cancer closer to the anus.[12]

In addition, CRT is commonly used to avoid positive CRM and to decrease LR. The CRM is well known as a powerful indicator for LR,[13] and the CRM around the anal canal is likely to represent a risk factor for LR when ISR is carried out. Computed tomography, magnetic resonance imaging (MRI), and digital examination are commonly used to evaluate tumor invasion to the anal canal complex. A MRI study has demonstrated no invasion to the EAS when the distance between the lower edge of the tumor and the DL is ≥2 cm.[60] This study was supported by a histopathological investigation of

whole-mount sections.[61] Moreover, Salerno *et al.* reported that MRI can predict invasion to the ISS.[62] The utility of MRI has been emphasized for facilitating a successful operation with negative CRM.[63,64] In contrast, Dent *et al.* have reported that MRI cannot predict histological tumor involvement of CRM.[65] The validity and reproducibility of the diagnosis require further investigation.[65,66]

To avoid a risk of positive CRM, the ESR procedure may be suitable for a tumor with suspected invasion into the ISS and/or EAS.[17,49] The same strategy appears in Russian and Korean studies,[44,53] and the concept is supported by a histopathological investigation.[61] However, the ESR showed a higher positive CRM rate (36.7%).[37] Surgery alone seems to be difficult for achieving local control. Most authors agree that any tumor invading the EAS (T4 tumor) should be treated using chemoradiotherapy followed by APR.

4.4 | Oncological outcomes

Local recurrence is a serious concern after ISR, and occurs in the pelvic cavity including at the anastomotic site. The rate of LR after ISR varies from 0% to 22.7%, lower than that after APR (10–57%) for mid or low rectal cancer.[27,31,67] Neoadjuvant CRT affects the down-sizing of tumor and down-staging of disease, and is often used as a standard strategy to avoid a positive CRM and LR in rectal cancer patients.[68–72] However, some questions remain as to whether neoadjuvant CRT should be more widely applied for patients who would undergo ISR. CRT is associated with higher surgical complications,[68,69] a negative impact on anal function,[45,70] and sexual disorder,[71] and has no clear survival benefit.[72] In Japan, preoperative neoadjuvant CRT has not been routinely carried out for resectable T1, T2 and T3 tumors regardless of the presence or absence of lymph node metastasis. Recently, Akagi *et al.* reported a low rate of LR (4.8%) without the use of neoadjuvant CRT.[35] Disease-free and overall 5-year survival rates were excellent, with ranges of 68–86% and 76–97%, respectively.[21–33,35] These results were consistent with those after APR or Parks' CAA.[29,35,58,73] ISR seems to be oncologically acceptable, but ESR should be carefully selected because of worse survival compared to ISR.[37]

With regard to laparoscopic-ISR, several surgeons reported that the surgical and oncological outcomes were equivalent to open surgery.[38–42]

However, the surgical techniques are not yet established, and regarded as more complex with difficulties in pelvic exposure, dissection, and sphincter preservation.

4.5 | Functional outcomes

Anal dysfunction is one of the serious potential problems after ISR. However, data from laparoscopic-ISR was not sufficient for estimation. Clinical assessment concerning stool frequency, fragmentation, urgency, soiling, and fecal incontinence varied widely in open-ISR. Anal continence assessed by the Kirwan grade[74] and the Wexner score[75] appeared relatively good. Anorectal manometric examination may be useful for an objective assessment of anal function. Generally, maximum resting pressure (MRP) is mainly affected by the IAS and, in part, by the EAS.[76] MRP gradually recovered over time after ISR,[14,15,19] and anal function improved over time.[23,27] Some authors reported that colonic J-pouch anastomosis offered superiority in bowel frequency, urgency control, tolerable volume, Wexner score, and fecal incontinence severity index (FISI)[77] compared with the straight anastomosis.[20,43,78] Moreover, the C-pouch and smooth muscle plasty procedures improved anal function following ISR.[30,44] However, these procedures may be difficult in obese patients and/or in male patients with a narrow pelvis. Also, neoadjuvant CRT is an adverse factor for anal continence following ISR.[28,45] QoL such as physical, social and psychological aspects of a patient's life is likely to be affected by anal dysfunction.[28,79] QoL outcomes of ISR patients were relatively good based on the SF-36, EORTC QLQ-C30, and FIQL scales.[20,46,48] However, further studies are required to evaluate the QoL.

5 | CONCLUSION

Surgical and oncological outcomes after open- and laparoscopic-ISR seem to be acceptable. The ISR technique seems to be a valid alternative to APR in selected patients with a very low rectal cancer. However, the necessity for ISR and expectations of QoL impairment as a result of functional disorder should be fully discussed with patients before surgery.

CONFLICTS OF INTEREST

Authors declare no conflicts of interest for this article.

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SUPPORTING INFORMATION

Additional Supporting Information may be found online in the supporting information tab for this article.

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